

CLAIMS

What is claimed is:

- 5 1. A method for a network element to support a protected communication link in a communication network, the method comprises the steps of:

receiving a link command to establish a communication link,
10 wherein the link command includes link protection criteria;

determining whether the network element is a termination node of the communication link;

- 15 when the network element is not a termination node of the communication link, determining an optimal path for the communication link via a plurality of network elements of the communication network based on the link protection criteria;

20

determining type of path to an adjacent one of the plurality of network elements based on link coupling protocol of coupling to the adjacent one of the plurality of network elements; and

processing the link command based on the type of path to the adjacent one of the plurality of network elements.

- 5 2. The method of claim 1, wherein the processing the link command further comprises:

when the link coupling protocol is UPSR, determining support needed for the communication link;

10

when the supported needed is to add a connection, determining type of protection based on the link protection criteria;

- 15 when the type of protection is unprotected/preemptable:

identifying a protect ring having a working path and a back-up path;

- 20 assigning resources with respect to the adjacent one of the plurality of network elements in the back-up path;

FOI 2009-09-22-01

generating a network element link command to establish the communication link as an unprotected/preemptable link in the back-up path; and

- 5 providing the network element link command to the adjacent one of the plurality of network elements.

3. The method of claim 2 further comprises:

- 10 when the type of protection is unprotected/non-preemptable:

creating a protect ring having a first working path and a second working path;

- 15 assigning resources with respect to the adjacent one of the plurality of network elements in the first working path;

generating a network element link command to establish the communication link as an unprotected/non-preemptable link

- 20 in the first working path; and

providing the network element link command to the adjacent one of the plurality of network elements.

096366-096366

when the type of protection is unprotected/non-preemptable:

assigning resources with respect to the adjacent one of the
10 plurality of network elements in the second working path;

providing the network element link command to the adjacent one of the plurality of network elements.

when the link coupling protocol is BLSR, determining support needed for the communication link;

when the supported needed is to add a connection,
determining type of protection based on the link protection
criteria;

5 when the type of protection is unprotected/preemptable:

identifying a protect ring having a working path and a
back-up path;

10 assigning resources with respect to each network element in
the back-up path;

generating a network element link command to establish the
communication link as an unprotected/preemptable link; and

15

providing the network element link command to the adjacent
one of the plurality of network elements that is adjacent
to the protect ring.

20 6. The method of claim 5 further comprises:

when the type of protection is unprotected/non-preemptable:

0995366-0995366

creating a protect ring having a first working path and a second working path;

assigning resources with respect to each network element in
5 the first working path;

generating a network element link command to establish the communication link as an unprotected/non-preemptable link in the first working path; and

10

providing the network element link command to the adjacent one of the plurality of network elements that is adjacent to the protect ring.

15 7. The method of claim 5 further comprises:

when the type of protection is unprotected/non-preemptable:

identifying a protect ring having a first working path and
20 a second working path, wherein the second working path is available;

assigning resources with respect to each network element in the second working path;

TO 250" 9965550

generating a network element link command to establish the communication link as an unprotected/non-preemptable link in the second working path; and

5

providing the network element link command to the adjacent one of the plurality of network elements that is adjacent to the protect ring.

10 8. The method of claim 1, wherein the processing the link
command further comprises:

when the link coupling protocol is linear, determining type
of protection based on the link protection criteria;

15

when the type of protection is one-to-one protection:

assigning first resources with respect to the adjacent one
of the plurality of network elements;

20

assigning second resources with respect to the adjacent one
of the plurality of network elements;

generating a network element link command to establish the communication link as an protected link; and

providing the network element link command to the adjacent

5 one of the plurality of network elements.

09965366-092704
FOI/260-9965366

9. A method for a network element to support a protected communication link in a communication network, the method comprises the steps of:

- 5 receiving a link command that includes link protection criteria;

determining whether the link command is a network manager link command or a network element link command, wherein the

- 10 link command identifies at least one of a first port and a second port of the communication link;

when the link command is a network manager link command:

- 15 determining type of the link command;

when the type of the link command is an establish a connection command:

- 20 determining an optimal path for the communication link via a plurality of network elements of the communication network in accordance with the link protection criteria;

determining type of path to an adjacent one of the plurality of network elements based on link coupling protocol of coupling to the adjacent one of the plurality of network elements; and

5

processing the link command based on the type of path to the adjacent one of the plurality of network elements.

10. The method of claim 9 further comprises:

10

when the link command is a network element link command, determining type of the link command;

when the type of the link command is an establish a

15 connection command, determining whether the network element is a termination node of the communication link;

when the network element is not a termination node of the communication link:

20

determining an optimal path for the communication link via a plurality of network elements of the communication network based on the link protection criteria;

036536-0630
T036536-0630

determining type of path to an adjacent one of the plurality of network elements based on link coupling protocol of coupling to the adjacent one of the plurality of network elements; and

5

processing the link command based on the type of path to the adjacent one of the plurality of network elements.

11. The method of claim 9, wherein the processing the link command further comprises:

10

when the link coupling protocol is UPSR, determining support needed for the communication link;

15

when the supported needed is to add a connection, determining type of protection based on the link protection criteria;

when the type of protection is unprotected/preemptable:

20

identifying a protect ring having a working path and a back-up path;

09/26/2009 09:59:59

assigning resources with respect to the adjacent one of the plurality of network elements in the back-up path;

generating a network element link command to establish the
5 communication link as an unprotected/preemptable link in the back-up path; and

providing the network element link command to the adjacent one of the plurality of network elements.

10

12. The method of claim 11 further comprises:

when the type of protection is unprotected/non-preemptable:

15 creating a protect ring having a first working path and a second working path;

assigning resources with respect to the adjacent one of the plurality of network elements in the first working path;

20

generating a network element link command to establish the communication link as an unprotected/non-preemptable link in the first working path; and

T02250"99E39650

providing the network element link command to the adjacent one of the plurality of network elements.

13. The method of claim 11 further comprises:

5

when the type of protection is unprotected/non-preemptable:

10

identifying a protect ring having a first working path and a second working path, wherein the second working path is available;

15

assigning resources with respect to the adjacent one of the plurality of network elements in the second working path; generating a network element link command to establish the communication link as an unprotected/non-preemptable link in the second working path; and

20

providing the network element link command to the adjacent one of the plurality of network elements.

14. The method of claim 9, wherein the processing the link command further comprises:

when the link coupling protocol is BLSR, determining support needed for the communication link;

when the supported needed is to add a connection,

- 5 determining type of protection based on the link protection criteria;

when the type of protection is unprotected/preemptable:

- 10 identifying a protect ring having a working path and a back-up path;

assigning resources with respect to each network element in the back-up path;

- 15 generating a network element link command to establish the communication link as an unprotected/preemptable link; and

providing the network element link command to the adjacent

- 20 one of the plurality of network elements that is adjacent to the protect ring.

15. The method of claim 14 further comprises:

```
creating a protect ring having a first working path and a
second working path;
```

assigning resources with respect to each network element in
the first working path;

10

15

16. The method of claim 14 further comprises:

when the type of protection is unprotected/non-preemptable:

identifying a protect ring having a first working path and
a second working path, wherein the second working path is
available;

assigning resources with respect to each network element in the second working path;

generating a network element link command to establish the

- 5 communication link as an unprotected/non-preemptable link in the second working path; and

providing the network element link command to the adjacent

one of the plurality of network elements that is adjacent

- 10 to the protect ring.

17. The method of claim 9, wherein the processing the link command further comprises:

- 15 when the link coupling protocol is linear, determining type of protection based on the link protection criteria;

when the type of protection is one-to-one protection:

- 20 assigning first resources with respect to the adjacent one of the plurality of network elements;

assigning second resources with respect to the adjacent one of the plurality of network elements;

generating a network element link command to establish the communication link as an protected link; and

- 5 providing the network element link command to the adjacent one of the plurality of network elements.

0995336.092704

determine type of path to an adjacent one of the plurality of network elements based on link coupling protocol of coupling to the adjacent one of the plurality of network elements; and

5

process the link command based on the type of path to the adjacent one of the plurality of network elements.

19. The network element of claim 18, wherein the memory
10 further comprises operational instructions that cause the processing module to process the link command by:

when the link coupling protocol is UPSR, determining support needed for the communication link;

15

when the supported needed is to add a connection,
determining type of protection based on the link protection criteria;

20 when the type of protection is unprotected/preemptable:

identifying a protect ring having a working path and a back-up path;

FOR OFFICIAL USE ONLY

assigning resources with respect to the adjacent one of the plurality of network elements in the back-up path;

generating a network element link command to establish the
5 communication link as an unprotected/preemptable link in the back-up path; and

providing the network element link command to the adjacent one of the plurality of network elements.

10

20. The network element of claim 19, wherein the memory further comprises operational instructions that cause the processing module to:

15 when the type of protection is unprotected/non-preemptable:

create a protect ring having a first working path and a second working path;

20 assign resources with respect to the adjacent one of the plurality of network elements in the first working path;

FOIA b 7 - DATED 09/26/2011

5 provide the network element link command to the adjacent
one of the plurality of network elements.

when the type of protection is unprotected/non-preemptable:

assign resources with respect to the adjacent one of the plurality of network elements in the second working path;

20

generate a network element link command to establish the communication link as an unprotected/non-preemptable link in the second working path; and

provide the network element link command to the adjacent one of the plurality of network elements.

22. The network element of claim 18, wherein the memory
5 further comprises operational instructions that cause the processing module to process the link command by:

when the link coupling protocol is BLSR, determine support needed for the communication link;

10

when the supported needed is to add a connection, determine type of protection based on the link protection criteria;

when the type of protection is unprotected/preemptable:

15

identify a protect ring having a working path and a back-up path;

assign resources with respect to each network element in

20 the back-up path;

generate a network element link command to establish the communication link as an unprotected/preemptable link; and

10965366-092704
102260-9959660

provide the network element link command to the adjacent one of the plurality of network elements that is adjacent to the protect ring.

- 5 23. The network element of claim 22, wherein the memory further comprises operational instructions that cause the processing module to:

when the type of protection is unprotected/non-preemptable:

10

create a protect ring having a first working path and a second working path;

assign resources with respect to each network element in

15 the first working path;

generate a network element link command to establish the communication link as an unprotected/non-preemptable link in the first working path; and

20

provide the network element link command to the adjacent one of the plurality of network elements that is adjacent to the protect ring.

102260-995960

5 when the type of protection is unprotected/non-preemptable:

10

15

provide the network element link command to the adjacent one of the plurality of network elements that is adjacent to the protect ring.

25. The network element of claim 18, wherein the memory further comprises operational instructions that cause the processing module to process the link command by:

when the link coupling protocol is linear, determining type of protection based on the link protection criteria;

5 when the type of protection is one-to-one protection:

assigning first resources with respect to the adjacent one of the plurality of network elements;

10 assigning second resources with respect to the adjacent one of the plurality of network elements;

generating a network element link command to establish the communication link as an protected link; and

15

providing the network element link command to the adjacent one of the plurality of network elements.

0965336-092704
FOZ2260-99659660

processing module; and

memory operably coupled to the processing module, wherein
the memory includes operational instructions to:

```
10 criteria;
```

15 second port of the communication link;

```
determine type of the link command;
```

when the type of the link command is an establish a connection command:

determine an optimal path for the communication link via a plurality of network elements of the communication network in accordance with the link protection criteria;

- 5 determine type of path to an adjacent one of the plurality of network elements based on link coupling protocol of coupling to the adjacent one of the plurality of network elements; and

- 10 process the link command based on the type of path to the adjacent one of the plurality of network elements.

27. The network element of claim 26, wherein the memory further comprises operational instructions that cause the

- 15 processing module to:

when the link command is a network element link command, determine type of the link command;

- 20 when the type of the link command is an establish a connection command, determine whether the network element is a termination node of the communication link;

when the network element is not a termination node of the communication link:

determine an optimal path for the communication link via a
5 plurality of network elements of the communication network
based on the link protection criteria;

determine type of path to an adjacent one of the plurality
of network elements based on link coupling protocol of
10 coupling to the adjacent one of the plurality of network
elements; and

process the link command based on the type of path to the adjacent one of the plurality of network elements.

15

28. The network element of claim 26, wherein the memory further comprises operational instructions that cause the processing module to process the link command by:

20 when the link coupling protocol is UPSR, determining
support needed for the communication link;

when the supported needed is to add a connection,
determining type of protection based on the link protection
criteria;

5 when the type of protection is unprotected/preemptable:

identifying a protect ring having a working path and a
back-up path;

10 assigning resources with respect to the adjacent one of the
plurality of network elements in the back-up path;

generating a network element link command to establish the
communication link as an unprotected/preemptable link in

15 the back-up path; and

providing the network element link command to the adjacent
one of the plurality of network elements.

20 29. The network element of claim 28, wherein the memory
further comprises operational instructions that cause the
processing module to:

when the type of protection is unprotected/non-preemptable:

095536-092704

create a protect ring having a first working path and a second working path;

- 5 assign resources with respect to the adjacent one of the plurality of network elements in the first working path;

generate a network element link command to establish the communication link as an unprotected/non-preemptable link

- 10 in the first working path; and

provide the network element link command to the adjacent one of the plurality of network elements.

- 15 30. The network element of claim 28, wherein the memory further comprises operational instructions that cause the processing module to:

when the type of protection is unprotected/non-preemptable:

20

identify a protect ring having a first working path and a second working path, wherein the second working path is available;

095536-093701
FOZSO"9959660

assign resources with respect to the adjacent one of the plurality of network elements in the second working path;

generate a network element link command to establish the
5 communication link as an unprotected/non-preemptable link in the second working path; and

provide the network element link command to the adjacent one of the plurality of network elements.

10

31. The network element of claim 26, wherein the memory further comprises operational instructions that cause the processing module to:

15 when the link coupling protocol is BLSR, determine support needed for the communication link;

when the supported needed is to add a connection, determine type of protection based on the link protection criteria;

20

when the type of protection is unprotected/preemptable:

identify a protect ring having a working path and a back-up path;

T02250-995950

assign resources with respect to each network element in the back-up path;

- 5 generate a network element link command to establish the communication link as an unprotected/preemptable link; and

provide the network element link command to the adjacent one of the plurality of network elements that is adjacent

- 10 to the protect ring.

32. The network element of claim 31, wherein the memory further comprises operational instructions that cause the processing module to:

15

when the type of protection is unprotected/non-preemptable:

create a protect ring having a first working path and a second working path;

20

assign resources with respect to each network element in the first working path;

096536-092704
10/26/99 9:55:50

generate a network element link command to establish the communication link as an unprotected/non-preemptable link in the first working path; and

- 5 provide the network element link command to the adjacent one of the plurality of network elements that is adjacent to the protect ring.

33. The network element of claim 31, wherein the memory
10 further comprises operational instructions that cause the processing module to:

when the type of protection is unprotected/non-preemptable:

- 15 identify a protect ring having a first working path and a second working path, wherein the second working path is available;

- assign resources with respect to each network element in
20 the second working path;

generate a network element link command to establish the communication link as an unprotected/non-preemptable link in the second working path; and

FOIA b 7 - D

provide the network element link command to the adjacent one of the plurality of network elements that is adjacent to the protect ring.

5

34. The network element of claim 26, wherein the memory further comprises operational instructions that cause the processing module to process the link command by:

10 when the link coupling protocol is linear, determining type
of protection based on the link protection criteria;

when the type of protection is one-to-one protection:

15 assigning first resources with respect to the adjacent one
of the plurality of network elements;

assigning second resources with respect to the adjacent one
of the plurality of network elements;

20

generating a network element link command to establish the communication link as an protected link; and

providing the network element link command to the adjacent one of the plurality of network elements.

095536 092701
T02260 095550